Systems Thinking for Social Issues

Understanding Pendency of Undertrials at Magistrate and Sessions Courts, Mumbai

By

Technology Development Solution Cell (TDSC), IIT Bombay

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Disclaimer: While the report has been prepared based on inputs from several experts, project team is solely responsible for any errors in the report.

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1. Background

Systems Thinking (ST) is an approach that involves understanding and analysing complex systems by examining their interrelationships and interactions. It is a way of thinking about problems that recognise the interconnectedness of different parts of a system, feedback dynamics, and how changes in one part can affect the system. Within systems thinking, dynamic modelling specifically allows us to understand the behaviour of systems over time by creating computer simulations that enable us to experiment with different variables and scenarios to see how they affect the system. Various case studies highlight the usefulness of applying systems thinking and system dynamics (SD) modelling.

We undertook a research project demonstrating the value of using the ST approach and tools like Systems Mapping and Dynamic Modelling to understand complex problems and suggest effective solutions for social problems. The project's main aim was to acquire a holistic perspective on the chosen system and its issues using tools and techniques under ST. The broader objectives for the project were as follows:

1. To apply systems thinking methodologies to gain a holistic understanding of a chosen system and its problems
2. To develop models that capture the underlying dynamics and interdependence of the system
3. To provide recommendations based on the study's findings that can help improve the system
4. To disseminate findings from the study to encourage the adoption of systems thinking for solving complex problems

We are exploring the ST application in multiple areas such as Groundwater Extraction for Irrigation, Emergence of Antibiotic Resistance, and Dynamics of Public vs Private Transport Systems and Pendendy in Justice System. However, given the availability of subject matter experts and resources, we decided to choose the application of systems thinking to the Indian Justice System to look at the issue of pendency specifically.

The 245th Law Commission report (Law Commission of India, 2014) defines Pendency as “All cases instituted but not disposed of, regardless of when the case was instituted.”

Pendency is also understood as the time taken for the disposal of cases. It also defines Delay as "A case that has been in the court or judicial system for longer than the normal time that it should take for a case of that type to be disposed of."

The Indian Justice System has been plagued by the issue of the rising backlog of cases across the hierarchy of courts for well over a decade now, with an annual growth rate of about 2.8% across all courts. As of 2021, over 4.5 crore cases were pending across all courts in India (PRS Legislative Research, 2021). These numbers indicate the deficiencies within the existing grievance redressal mechanisms of the judicial system that create delays and increase pendency.

An efficient judicial system is essential for upholding the rule of law. Delays in disposing of cases can undermine people's faith in the judicial system. The problem of pendency is further exacerbated by the previously accumulated pending cases that create a vicious cycle, making it difficult for judges to focus on the new cases, resulting in further delays in delivering justice. Besides, with pending cases, judges might not feel satisfied with their job since there will always be pressure to reduce the number of cases, affecting their overall performance due to the time taken for each case. Therefore, it is essential to understand the problem and propagate solutions that can help reduce delays.

There are multiple dimensions to understanding the situation, consequently, various solutions can be uncovered based on that. While reading through a few articles, one persistent recommendation that kept coming up was to raise the number of judges to improve the disposal rate for addressing the issue of pendency. A working paper "Judicial Policy Evaluation Framework" by Daksh (Daksh, 2019a) highlightes that increasing Judges' strength, along with administrative cadre reforms, will directly increase court efficiency by increasing the number of judicial staff capable of dealing with cases and delays, as well as judges' individual productivity. Similarly, Mr. Shailesh Gandhi, Former Central Information Officer, suggests that in order to reduce pendency, there is a need to improve the disposal rate by increasing the number of judges to fill the already allocated vacant seats in courts (Gandhi, 2019). Another article highlights an intriguing solution to solve the pendency, suggesting that there is an immediate need to consider dropping trial proceedings and releasing those criminal undertrial prisoners, who are first-time offenders involved in less serious offences and have already spent significant time in jail as a

one-time measure (Choudhary, 2023). It would help ease the backlog of pending cases in trial courts and the overcrowded jails.

These solutions are unique; however, given the legal system's complexity, many of these recommendations made us ponder and feel intrigued about whether these solutions would be truly beneficial or merely scratch the surface of the problem.

The judicial system has numerous interconnected components, such as judges, lawyers, litigants, court employees, infrastructure, and legislation. Due to these interconnections, many non-linear dynamic behaviours can emerge that can keep the system in its current form or even give a false sense of accomplishment. Stock (Pending cases), Flows (Case institution and disposition), Feedback and Delay (time taken to dispose) are key characteristics that determine the behaviour of a system, because of which we realised that system dynamics is a natural tool that lends itself to exploring this problem. Considering the pendency problem's intrinsic complexity and non-linearity, we began to approach it through a system dynamics lens in our quest to understand it better.

Besides, many studies shed light on the application of system dynamics modelling in the domain of crime escalation, prevention and the legal and justice system concerning them. One case study looks at the complex problem of drug-related crimes in the Western Cape province of South Africa through the systems they are embedded in (Nyabadza & Coetzee, 2017), while another study summarised the utility of System Dynamics applications in violence and injury prevention research and practice (Naumann et al., 2019). Yet another study showcases how a low perceived probability of being punished encourages certain individuals to further engage in illegitimate crimes. As the crimes increase, the legal system's ability to cope with them diminishes (López & Zúñiga, 2001). A group of researchers at Radboud University Nijmegen also developed a systems dynamics model for the Ministry of Justice in the Netherlands to gain insight into the combined effects of three developments: an increase in the caseload, investments in different phases of criminal justice administration and contextual developments such as increased complexity of cases (Rouwette et al., 2007). This model was developed in close consultations with representatives from the police force, public prosecution, courts and sentence execution, probation services, WODC (Scientific Research and Documentation Center), and different departments of the Ministry of Justice. The model helped understand the case and

person flow in the Dutch criminal justice system over 14 years monthly. The model also acted as a decision support system to give insight into the effects of a proposed law.

Although plenty of studies show the application of systems thinking and system dynamics modelling in the justice system, there are none in the context of India. We realise that a similar effort can benefit the Indian justice system. Given the quantum of the problem in India, there is a need to look at the problem of pendency from a new lens that can help understand the problem holistically.

A well-known legal maxim is used in judicial parlance: "*Justice delayed is justice denied*." The absence of timely redressal is as good as no redressal at all. The number of pending cases indicates deficiencies within the judicial system. We want to put our efforts towards having a non-zero probability of creating an impact to solve the issue. We are motivated by the fact that making the judiciary system more robust and accessible to every citizen is important from both the legal and the humanitarian standpoint. Applying the ST approach can not only facilitate the understanding of interactions and mental models of different stakeholders but also equip them with the necessary tools and skills to unpack the dynamic complexity of problems in the system and help them design impactful solutions.

In this project, we focus on developing system dynamic models to understand the different dynamics determining the pendency of criminal cases. We model an abstract justice system and use the data from the Bombay high court and Mumbai sub-ordinate courts to simulate the dynamics. The models takes data from Bombay high court to show the dynamics of abstract justice systems taking an aggregated view on pending cases. Similarly it takes data for sub-ordinate courts to simulate the dynamics of abstract disaggregated view of pending cases i.e disaggregation based on stages of a case.

We choose the pendency of criminal cases over civil cases for two reasons: The state has an essential role in criminal proceedings, and the pendency in criminal cases is critical from a human rights and development standpoint. The India Justice Report, 2022 highlights that 77% of the prison population is undertrial. The 78th Report of the Law Commission of India (1979) defines 'undertrial' as a person who is an unconvicted prisoner and has been detained in prison while the investigation, inquiry, or trial for the offence for which they are charged. Section 436A

of the Code of Criminal Procedure (CrPC) gives a right to an under-trial prisoner to seek bail on serving more than one-half of the maximum possible sentence on their personal bond with or without sureties. According to the section, no person can be detained in prison as an undertrial for a period exceeding the maximum possible sentence. This provision is, however, not applicable to those who are charged with offences punishable by the death sentence. Many undertrials have already spent the period commensurate with their crime in jail due to delays in investigation, lack of awareness of their rights, dysfunctional legal aid system etc (Sahoo & Jain , 2015) (Surendranath et al., 2021). So, it becomes critical to understand the dynamics of the pendency of undertrials.

We aim to demonstrate the value of using systems mapping and system dynamic modelling to understand the problem of pendency holistically. The broader objective of the paper is to model key dynamics contributing to pendency and test the impact of various proposed interventions.

2. Methodology

This section describes the methodology for scoping the justice system, understanding its issues, and developing systems maps. As shown in Figure 2.1, we took an iterative approach to develop different systems maps and systems dynamics models.

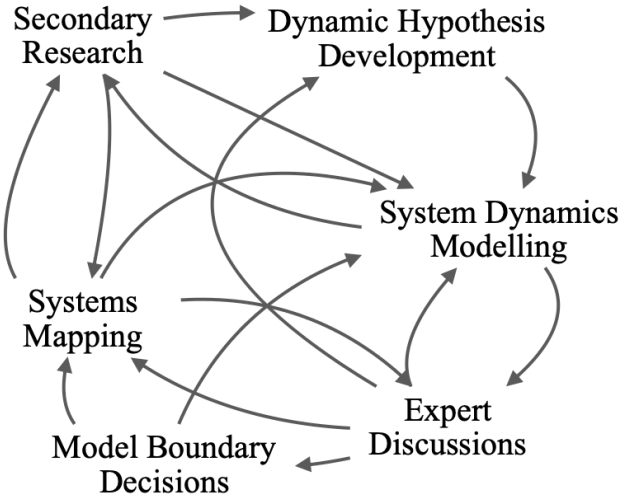

Figure 2.1 Research Methodology

2.1. Secondary Research

We broadly divided secondary research into literature and data reviews. We developed an understanding of various terminologies within judicial parlance, case procedural aspects, the role of stakeholders, and causes of delays by reviewing multiple research papers, blogs, and legal acts.

We referred to information management sources such as the National Judicial Data Grid (NJDG), E-court websites, India Code Digital repository, and Mumbai Prison Department reports to understand the pending cases and prison population statistics and get appropriate data to be used in the model.

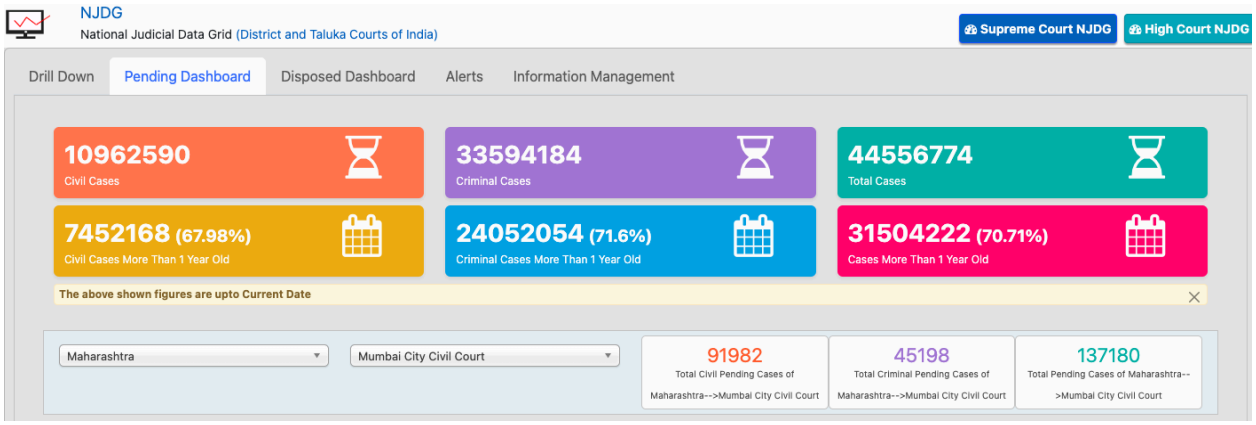

Figure 2.2 NJDG pending dashboard

2.2. Expert Discussions

The project started with identifying the experts from the justice system and engaging with them to discuss the subject matter. We engaged with experts belonging to diverse backgrounds such as a Program Director of a leading Law and Justice think-tank, practising advocates from the Magistrate Court, Sessions Court (Mumbai), and the Bombay High Court, and also the Principal and Professor of a Law college in Mumbai. The discussion was undertaken to understand the role of different stakeholders like advocates, judges, public prosecutors, plaintiffs and the police.

Multiple rounds of deliberations were undertaken with the experts for project scoping, building an understanding of how the justice system works, refining multiple versions of the procedural and causal maps used for developing the models, and validating the maps iteratively.

These deliberations helped us gain clarity regarding factors leading to delays in the disposal of cases and built our vocabulary in the justice system parlance.

2.3. Court Visits

In addition to expert discussions and secondary research, we visited the Magistrate and the Sessions' courts to observe real-time court proceedings. The project team visited courtrooms no. 31 and 34 of the Metropolitan Magistrate Court Vikhroli and courtroom no. 10 of the City Sessions Court in Fort Mumbai.

2.4. Systems Mapping and Modeling

We developed systems maps to understand various procedural flows in a criminal case. Based on these maps, we identified the model boundaries and built stock-flow diagrams (SFDs). A Stock Flow Diagram (SFD) is made up of stocks and flows to represent the dynamics of any system. A stock represents accumulation, while flows are mechanisms by which any stock changes. Inflows increase the stocks, while outflows decrease the stocks. Stocks are fundamental quantities that characterise the state of a system. In the case of the justice system, pending cases are considered to be a stock that represents the current state of the system. A stock-flow diagram can be simulated to understand the dynamic effect of various factors quantitatively and develop the what-if scenarios.

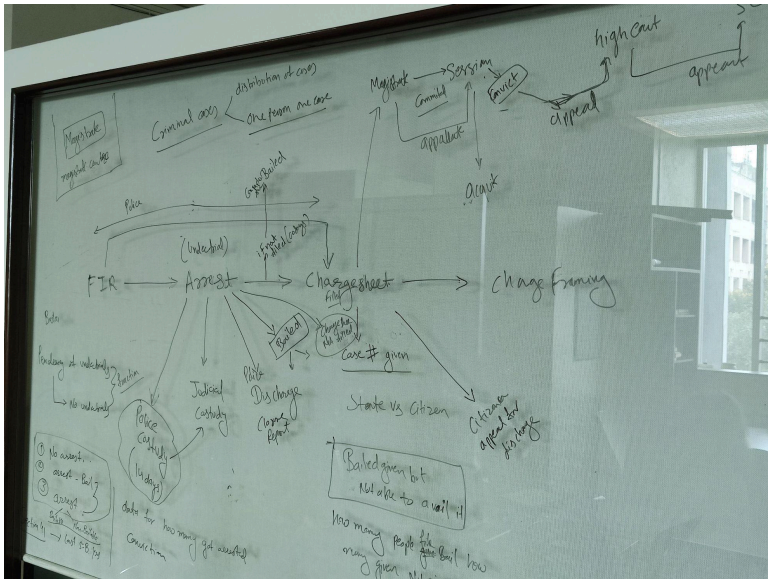

Figure 2.3 Brainstorming mapping exercise with experts

We take a stepwise model development approach to simulate the dynamics of pending cases. We start with a single stock model by aggregating all the pending cases across the procedural stages of a criminal case into a single stock. Further, we extend the model by disaggregating it into a chain of stocks to keep track of pending cases across different procedural stages. We again extend the model into a multi-stage SFD diagram to track the flow of pending cases across the procedural stage as well as the temporal dimension. These models are developed to showcase the behaviour of systems subjected to multiple feedbacks and stocks.

2.5 Project Timeline:

The project took place between April'23 to March'24 with the following timelines:

	April	May	June	July	August	September	October	November	December	January	February
Secondary Research											
Expert Discussion											
Court Visits											
Systems Mapping											
System Dynamic Modelling											

3. Case proceedings mapping and Model boundary

3.1 Case procedural mapping:

Figure 3.1 depicts the procedural map of a criminal case. The process starts with the police filing a First Information Report (FIR) upon intimation of a crime by someone. Based on the type of crime committed, there can be two types of offence: Bailable and Non-bailable. If the accused has committed a bailable offence and anticipates being arrested, they may apply for an Anticipatory Bail in advance. The police, on their part, will try to get the accused arrested. If they succeed in arresting the accused, the person must be presented in front of a magistrate judge within 24 hours of the arrest. A magistrate can direct the police to keep the accused under police custody if the police need to obtain crucial information from the accused. Otherwise, the

magistrate directs the police to send the accused into judicial custody. When an accused is kept under judicial custody, they are undertrial.

The accused can also apply for bail after the arrest. The bail application goes to the magistrate, who decides whether bail should be granted. Once bail is granted, the accused is out of custody and on bail. The sections of the Indian Penal Code applicable to the case need to be ascertained by the police by referring to the Code of Criminal Procedure (CrPC). Depending on the crime's seriousness, the chargesheet must be filed in the court within 60 days or 90 days of filing the FIR. If the charge sheet is not filed within the stipulated period, the person has the right to get bail without following due process. However, many accused are unaware of this right unless informed by their legal counsel.

Every case gets a case number assigned to it only after the chargesheet is filed. Once the case number is given, a subordinate court is also assigned for the hearings. The court assignment depends on the type of trial. As per the Code of Criminal Procedure, 1973, there are four types of trials for adjudicating criminal cases. The details of each trial are given in Table 3.1

Trial Type	**Description**
1. Summons Trial	An offence punishable with less than two years of imprisonment falls under this category.
2. Warrant Trial	Warrant cases refer to cases involving a criminal offence with the death penalty, life imprisonment, or imprisonment for a period exceeding two years. These cases typically involve severe and grave offences that are considered cognisable, allowing the police to make arrests without a warrant. A court of session tries the most severe warrant cases while Magistrates handle the rest (Hareesh A et al., n.d.)
3. Session Trial	If the offence is punishable by more than seven years in jail, life imprisonment, or death, the trial must be held in a Sessions court after being committed or referred to the court by a Magistrate.

4. Summary Trial	An offence which is punishable only with a fine or imprisonment for a term not exceeding six months with or without a fine, and any abetment of or attempt to commit any such offence.

Table 3.1 Types of Criminal Trials

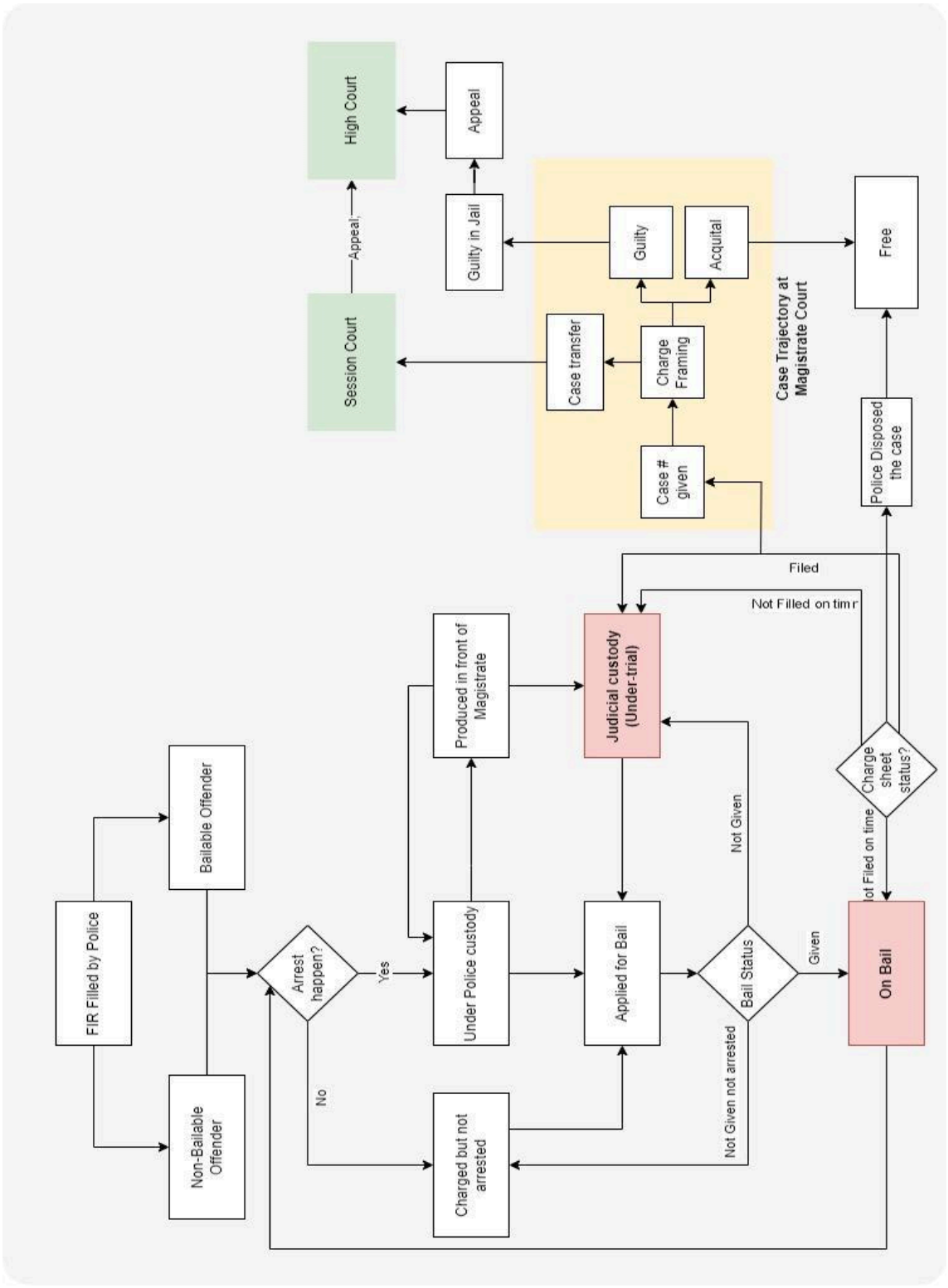

Figure 3.1 Criminal case procedural map

Each case follows a series of stages at the subordinate court as defined in the CrPC. There are broadly six stages, as described in Table 3.2.

Case Stages	Description
1. Appearance	When the accused need not be arrested as per the provisions of sec 41 of CrPC, the police issue a notice directing the person to appear before the court or at any other place as may be specified in the notice.
2. Framing of charges	It is the process of documenting and communicating the nature of the accusation that an accused would face. They are also informed that they would face trial for the said accusation and have the right to defend themselves (Reddy, 2021).
3. Trial (Evidence)	After the stage of hearings is over and the Court frames charges, both the plaintiff and defendant parties need to present the evidence in court, whereby examination-in-chief and cross-examination of the witnesses also occur (Yash, n.d.).
4. Statement of accused under section 313	According to Section 313 of CrPC, the trial court has the power to ask the accused to explain any circumstances that appear in evidence against him or her in their own words. However, the accused cannot be cross-examined regarding statements made u/s 313 (Ashwin, 2021).
5. Arguments	The parties to the dispute are asked to present their arguments and submit the list of evidence to substantiate those arguments.
6. Judgment	Judgment is what the judge writes regarding all the issues in the matter and the decision made on each of those issues on the grounds of a decree or order.

Table 3.2 Stage of criminal trials in magistrate and session courts

3.2. Model Boundry

Figure 3.2 shows a refined version of the procedural map discussed earlier to represent all the events in a criminal case life cycle. The map also shows the model boundary. Since there are numerous interconnected components, choosing the appropriate model boundary is imperative to understand the pendency. From expert deliberations, we find that the root cause of pendency starts with subordinate courts, and the focus needs to be on understanding the functioning of these courts. The role of the courts is very minimal before the appearance, and the duration for the processes before the appearance is relatively less compared to case proceedings at courts. Due to this, for modelling, we do not consider the processes that occur before the appearance, and we assume that these processes will have minimal effect on the pendency.

There are bail application-related events as well that create an additional load on the courts. Due to this, those who apply for bail get delayed in getting approval on bail applications. However, one thing to note is that bail and trial are two different processes that run in parallel, and the bail process lasts for relatively less duration than the trial process. Since bail doesn't play a significant role in determining the time to dispose of a case thus, it has minimal effect on pendency. For the same reason, we keep the bail application process out of our model boundary. Therefore, our systems dynamics model is limited to modelling the dynamics of cases' procedural stages at the subordinate and high courts that contribute to pendency.

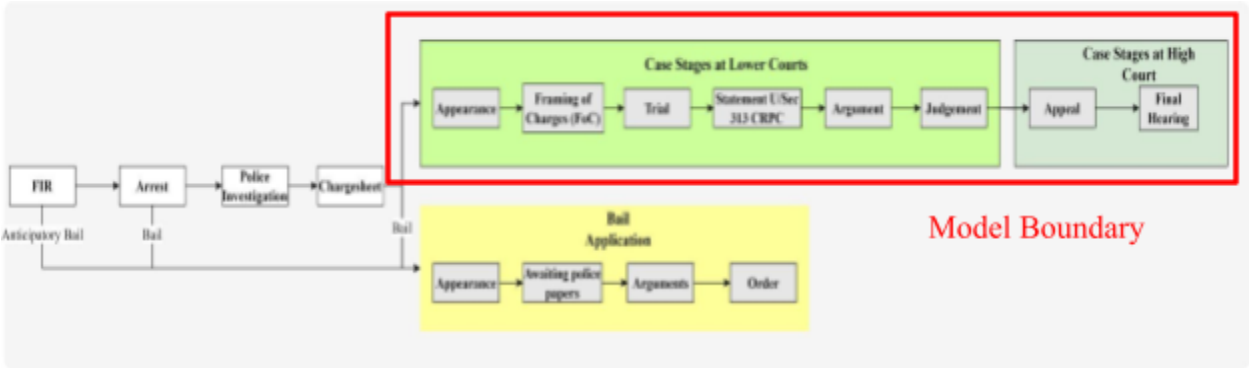

Figure 3.2 Criminal stagewise case procedural map and model boundary

4. Factors Causing Delay in Case Proceedings

There are multiple causes of the case proceedings getting delayed as the case progresses from one stage to another. These causes can be avoidable, unnecessary, necessary, unlawful, or unconstitutional (Feltes, 1989). Both individuals and institutions can be responsible for the cause of delays. Figure 4.1 shows the statistics for the delay reasons for session cases in Mumbai City Civil courts as per NJDG website. Apart from this multiple rounds of deliberation with experts helped us build a good understanding of how the justice system works and gain clarity regarding factors leading to delays in the disposal of cases. Below, we highlight some causal factors for pendency:

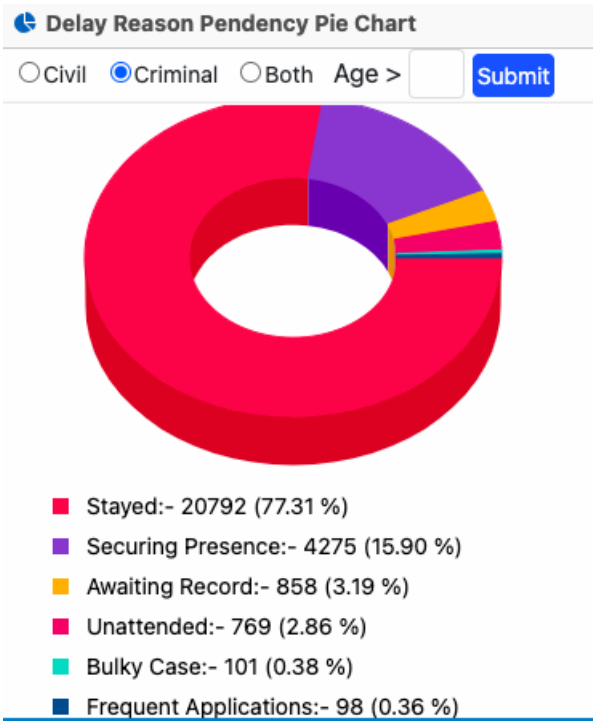

Figure 4.1 Criminal stagewise case procedural map and model boundary

- **Delay in the initial investigation** - Investigation police officers and experts can take time in an initial investigation to gather the evidence and witnesses. If an expert needs to conduct specialised examinations or analysis, the case investigation may be delayed. Sometimes, the unavailability of a specific expert to examine the pieces of evidence can cause delay.

- **Delay in chargesheet filing** - The chargesheet has to be filed within 60 days of arrest. For crimes with a sentence of greater than ten years imprisonment, it must be filed within 90 days of arrest. Many times police delay the chargesheet filing. Section 167 of CrPC provides the right to default bail to an accused if the probe agency fails to conclude the investigation and file a charge sheet within a stipulated period. Still, due to unawareness and the absence of a proper legal aid system, many undertrials are not able to exercise this right. Sometimes police also file incomplete chargesheets that cause delays.

- **Multiple summons issuance** - Police and Public Prosecutor (PP) usually do not submit a non-traceable report if a witness is not responding to summons; instead, they keep issuing summons, which causes delays in starting the trial. They do so since they do not want to lose the case, as it will reflect poorly on them.

- **Inaccurate case stage information in Roznama** - Sometimes, the information about the case stage as presented in the Roznama, i.e. the record of daily hearings of a court case by the Interpreter, is inaccurate or misleading. This causes unnecessary confusion and a waste of time for the advocate as well as the court since they prepare themselves for the hearings based on the stages mentioned in the Roznama.

- **Dependency on courtroom staff** - If the typist is on leave there is a postponement of hearing by the judge. Also, after an order has been passed by the judge, he or she will proofread the order, following which the typist will make corrections and keep it on the judge's desk for signature. Sometimes the orders keep lying around on the judge's desk for days, causing some delay.

- **Large number of witnesses and accused** - Judgment usually takes longer depending on the number of witnesses. Further, the death of one or multiple prosecution witnesses and/or accused also leads to further delay in the case.

- **Frequent adjournment demands by advocates** - Many times, advocates cause delays by asking for adjournments since they try to maintain their caseloads (Laws, 2016), and in many cases, they are getting paid per hearing basis from the client. Hence they are incentivised to ask for unnecessary adjournments. They ask for more time to gather evidence, research the law, file motions, or wait for certain events to occur. Denying these

requests is often seen as unfair, as new information could still come to light. Judges who consistently deny these requests may face backlash and challenges to their competency. Refusing these adjournments is difficult since refusal is considered unfairness towards the case (Fleming, 1973).

- **Inefficient case file management system** - Currently, the case files are being physically managed by the courtroom staff, who ensure that all files relating to the cases listed in a cause list are made available to the judge on a daily basis. In the cases that have been pending over a long time, files get misplaced or are not available, leading to further delays.

- **Delay in accessing legal assistance and quality of legal assistance** - Accessing prompt legal advice and assistance is crucial for ensuring a fair trial and the rule of law. Access to early legal aid promotes rights, efficiency, and fairness in the criminal justice system by ensuring that court hearings and procedures are effective (United Nations Office on Drugs and Crime, 2014). However, many undertrials are not able to get access to legal assistance due to unaffordable legal assistance because of socio-economic backwardness, unawareness about free legal aid, poor quality of the legal aid system (Surendranath et al., 2021) (Singh, n.d.).

- **Judicial productivity and caseload** - The disposal of cases depends on number of judges and the time spent by judges in hearing the cases. According to Beenstock and Haitovsky (2004), an increase in caseload leads to an increase in judge productivity due to pressure-induced productivity. Nevertheless, there is a limit to this relationship, and performance starts to decrease as the number of cases per judge increases.

5. Stock-flow models for undertrials

As discussed in the previous section, there are multiple factors that cause many feedback dynamics contributing to pendency. Modelling these dynamics requires extensive time and effort. Therefore, it is critical to build a simple model first and then extend it to a detailed complex model capturing all the feedback dynamics. We focus our stock-flow model-building efforts on modelling the pendency caused by the dynamics of judicial productivity and caseload.

5.1 Aggregated Model

In this model, we aggregate all pending criminal cases across procedural stages into one stock, “Undertrial Cases”, as illustrated in Figure 5.1. The "Case Institutionalisation Rate" and "Case Disposal Rates" represent the stock's inflow and outflow, respectively. The aggregated model simulates the pending criminal cases at Bombay High Court.

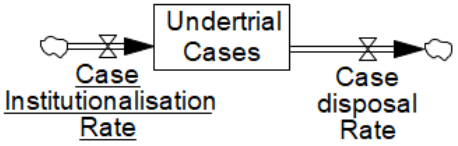

Figure 5.1 Aggregated model for pending criminal cases

The case institutionalisation rate is the total number of cases registered per year. It depends on the crime rate, population size, literacy rate, people’s trust in the judicial system etc. Similarly, the case disposal rate is the total number of cases disposed of per year. This rate is a function of the judicial productivity. This productivity is determined by the number of judges, their productive time and the time required to deliver judgment in a case. The time to delivery of judgment itself depends on the seriousness of the crime, the number of charges, the number of witnesses, etc. (Davila, 2015). Apart from the dependency of these rates on various factors linearly, there can also exist feedback relationships of these rates with pending cases. Figure 5.2 shows the trend of institutional and disposal for session cases in Mumbai City Civil court. Case disposal are always lower then the institution that will lead to increase in stock of pending cases.

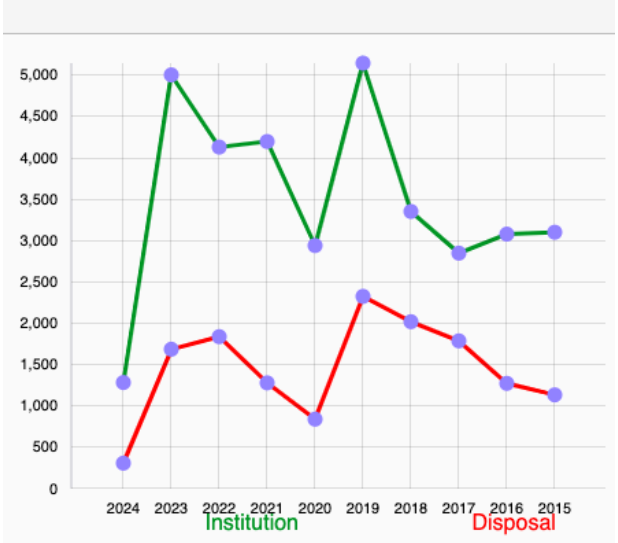

Figure 5.2 Institution and disposal trend for session cases in Mumbai City Civil Court

Three distinct linear and non-linear models are used to illustrate the dynamics of undertrial cases and judicial productivity. The following are the three models:

1. **Linear View (M1):** The case institutionalisation and disposal rate do not have any feedback relationship with undertrial cases
2. **Feedback View (M2):** The case disposal rate is in a feedback relationship with undertrial cases
3. **Feedback View (M3):** Both the case institutionalization rate and the case disposal rate are in feedback relationship with undertrial cases

For each of the above models, we simulate four scenarios by considering specific interventions to show their effect on pending cases. The scenarios are as follows:

Scenario	Intervention Description
1. Business-as-usual	There is no intervention
2. Fill the vacancies of judges	At the start of the simulation, all the judge vacancies of the Bombay High Court are filled by increasing the judge value from 69 to 94 at once.
3. Release of minor offenders	75,000 cases are disposed of at once after two years by releasing first-time petty crime offenders
4. Combine scenarios 2 and 3	Do both 2 and 3 interventions

Table 5.1 Model scenario description for aggregated model

5.1.1 Linear View (M1): The case institutionalisation and disposal rate don't have any feedback relationship with undertrial cases

This model is a representation of undertrial cases as a simplistic input-output linear model with no feedback relationships, as indicated in Figure 5.3. The case institutionalization rate is constant without any casual relationships. The case disposal rate is linear without having any feedback connection but a causal chain of numerous factors, as might be assumed by Daksh (2019a) and Gandhi (2019). In the model capacity of judgment per day represents the judicial productivity, and it is dependent on the number of judges, their productivity and the average

argument time needed per case. According to this model, the more judges, the more judicial productivity, thus less the number of undertrial cases, as also indicated by Mohamed (2022).

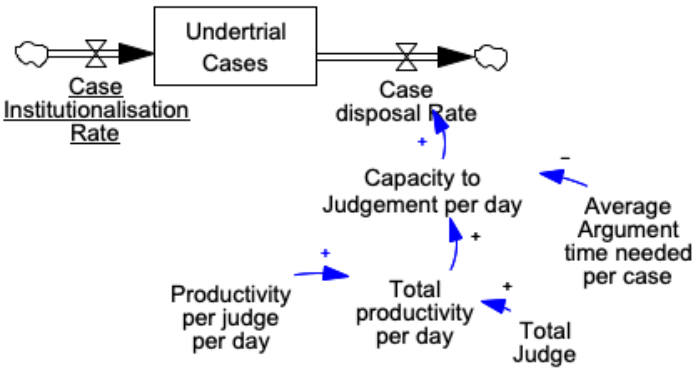

Figure 5.3 Undertrial cases with constant case institutionalisation and disposition rates

5.1.2 Feedback View (M2): The case disposal rate is in a feedback relationship with undertrial cases

To grasp the problem of pending cases and solve the inefficiency of the Indian Justice System at present, it is necessary to thoroughly study the various factors that influence it while also analysing the interaction between them. According to Mohamed (2022), the pending cases are negatively influenced by judicial productivity. It indicates that pendency will decrease as judicial productivity improves. They also emphasise that increasing the number of judges can improve productivity and, thus, the disposal rate. Our approach also emphasises the importance of judicial productivity and its dependency on the number of judges in resolving pending cases.

Currently, judicial productivity is understood as the number of cases disposed of every day per judge. This implies that it is linearly dependent on the number of judges and the time spent on hearings, as represented in the linear model M1 in the previous section. However, we argue that judicial productivity is affected not just by the number of judges and their per-day productivity but also by the pending cases themselves. Therefore, we must consider the feedback relationship between judicial productivity and pending cases as a critical causal relationship influencing judicial productivity. Since each new case offers a new context, there is a cost associated with context change during hearings. This cost reduces the per-day case resolution capacity and the disposal rate, thereby lowering judicial productivity.

As illustrated in figure 5.4, context-switching overhead can trap the judicial system in a vicious cycle in which as the number of cases increases, so does the amount of context-switching, reducing judicial productivity and disposal rates and increasing the number of cases even further, in the presence of a constant case institutionalisation rate. Accounting for this vicious cycle will have a substantial influence on the decisions to nominate new judges or fill vacancies to clear the pending cases.

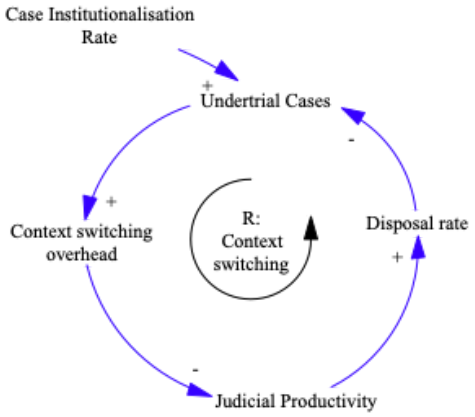

Figure 5.4 Context-switching overhead causal loop diagram

We extended the earlier model M1 to incorporate the feedback relationship between case disposal rate and undertrial cases, as shown in Figure 5.5. In this model, "capacity of judgment per day" is referred to as judicial productivity and the effect of context-switching overhead is shown using the "productivity degradation" factor.

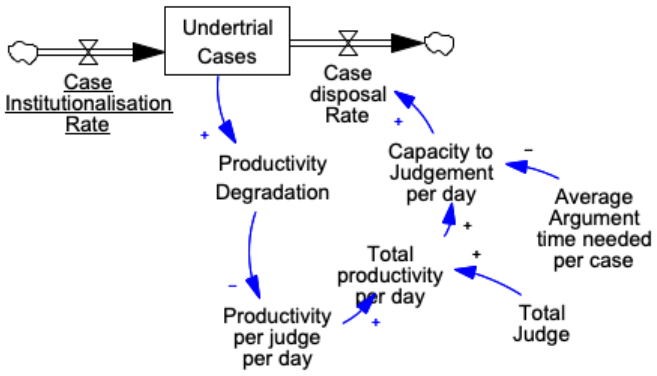

Figure 5.5 Context switching overhead stock-flow model

5.1.3 Feedback View (M3): Both the case institutionalization rate and the case disposal rate are in a feedback relationship with undertrial cases

According to Mukesh (2022), 68% of prisoners have not been convicted by a court for any crime in India. Many must wait years before the trial court even hears their cases. Understanding the effect of time spent in jail on undertrial cases becomes crucial. As the number of undertrial cases increases, so does the time required to resolve them, resulting in more time spent in jail by undertrial. According to Halley (2022), prolonging detention in undertrials may raise the likelihood of re-offending, therefore raising the case's institutionalisation rate. Many people in pretrial detention are innocent or accused of low-level offences that would not result in a jail sentence. However, they still experience negative consequences like finding and maintaining employment and housing associated with pretrial detention. These challenges can make them not live a law-abiding life and can potentially push them into crimes. In some circumstances, if a person has spent time in jail, it is assumed that they are potential offenders (suspects) in a new crime that occurred nearby, even if they did not commit the crime. So the next time any crime (petty or major doesn't matter) occurs in their neighbourhood, the first response of the police is to file a case against them, especially in the case of marginalised communities like De-notified Tribes (DNTs).

The average length of time defendants spend in jail during the undertrial process is total undertrial cases divided by the case disposal rate. So, as the number of undertrial cases increases, so does time spent in jail, which increases the risk of second time arrest, and has an impact on the case institutionalisation rate. As a result, there is a feedback relationship between the number of undertrial cases and the rate of institutionalisation.

As illustrated in Figure 5.6, the presence of two mutually reinforcing feedback loops will aggravate the issue of pending cases. If not carefully analysed, it will have a snowball effect on the undertrial cases.

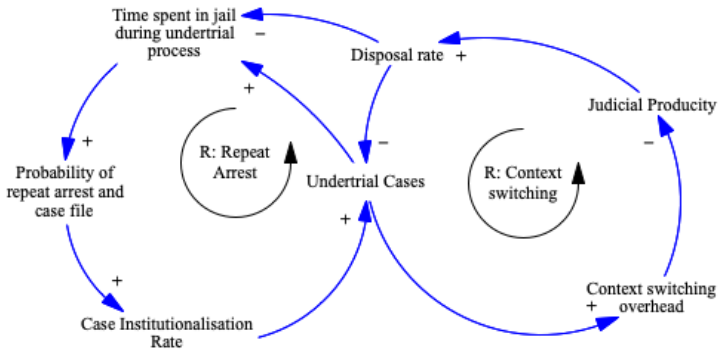

Figure 5.6 Repeat arrest and context-switching causal loop diagram

We create a model where the case disposal and institutionalisation rates are in a feedback relationship with undertrial cases, as shown in Figure 5.7. To model the system, some additional stocks are added to make the model simulatable. In this, the overall case disposal rate is a sum of two outflows from "undertrial case" stock; similarly, the overall institutionalisation rate is the sum of both inflows to the same stock.

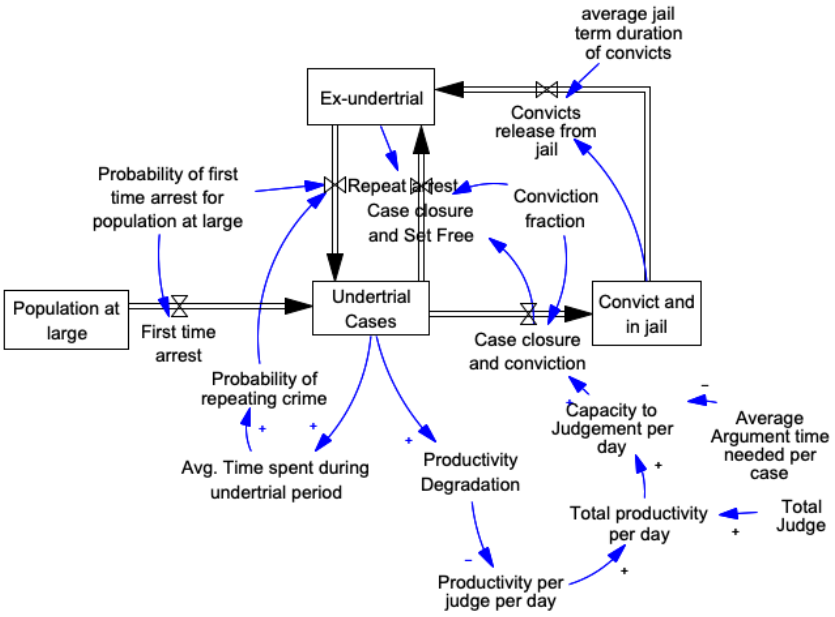

Figure 5.7 Repeat arrest and context switching stock-flow model

The limitation of the above models (M1, M2, M3) is that they do not account for the time spent by a case in different procedural stages. Also, they are limited to only two major feedback relationships however, there can be many more feedback relationships, given the complexity of the judicial system.

5.2 Multi-stage Model:

After discussing with experts and gathering information from secondary research to understand the different procedural stages, the above stock-flow model developed further. We create a multi-stage SFD by disaggregating the undertrial cases in model M1. This model accounts for the progression of cases along the temporal and procedural stage dimensions. As discussed earlier, each case progresses through the stages of a case proceeding cycle. At the same time, it remains in that stage for a significant amount of time; hence, we need to show progression in the temporal dimension as well. As shown in figure 5.78, National Judiciary Data Grid (NJDG) classifies cases into distinct temporal categories to show the age-wise pendency based on the duration the case has been pending for in a particular stage. For example, many cases might be at the appearance stage, but all may differ in the time they have spent in that stage. The temporal flow of cases is added by considering five temporal stages.

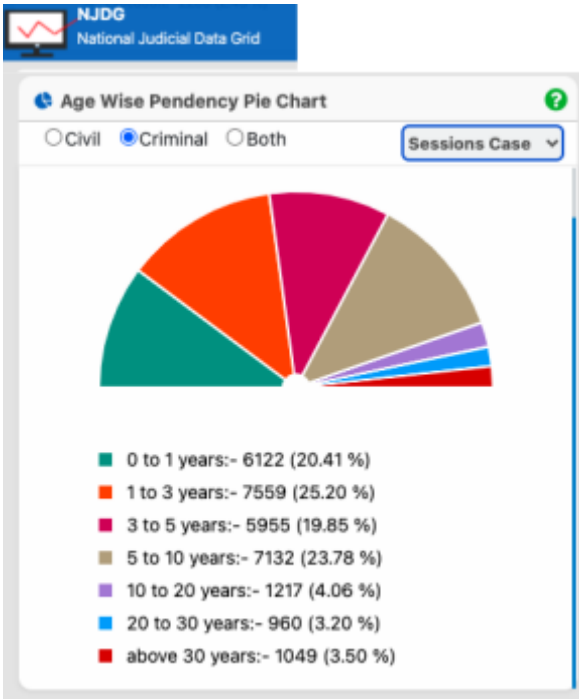

Figure 5.8: Age wise pendency of sessions case in Mumbai Citi Civil Courts

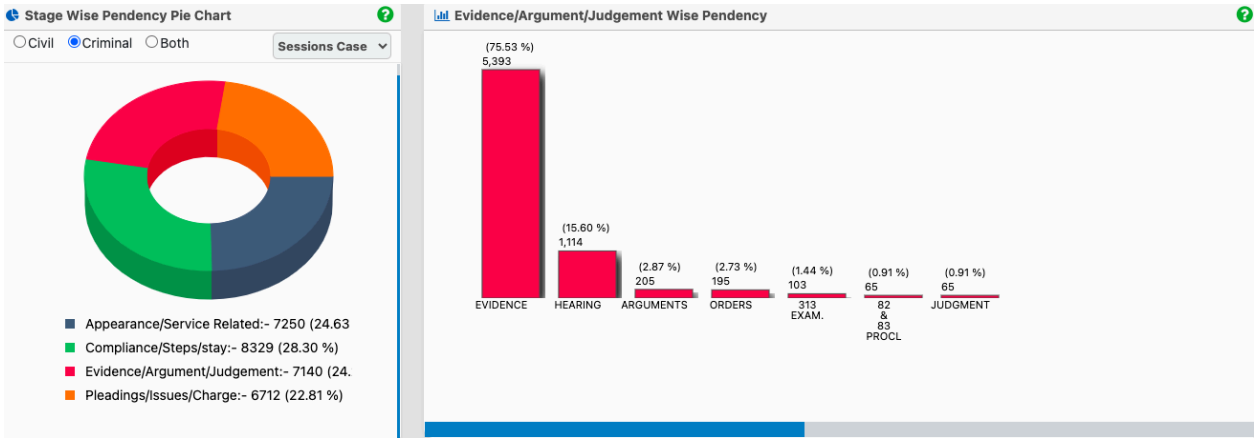

Figure 5.9: Stage-wise pendency of sessions case in Mumbai Citi Civil Courts

The "undertrial cases" stock is divided into chains of stocks to represent the number of pending cases at each case proceeding cycle. Similarly, these chains of stocks are repeated across the temporal scale to represent the number of pending cases at a particular stage and the time spent by them in the system, as shown in Figure 5.10. In this model, any feedback connection is not being taken into account for simplicity.

In the SFD, stocks have an ageing chain with co-flows (Sterman, 2000). Every stock has an inflow from the previous procedural stage as well as the previous temporal stage. Similarly, stocks have an outflow from one procedural stage to another and other outflows from one temporal stage to another. The diagram helps understand the landscape of pending cases across both time and space dimensions. We have not made this diagram simulatable for the project. However, it can be simulated by applying appropriate equations requiring further research to understand the different parameters affecting each flow rate.

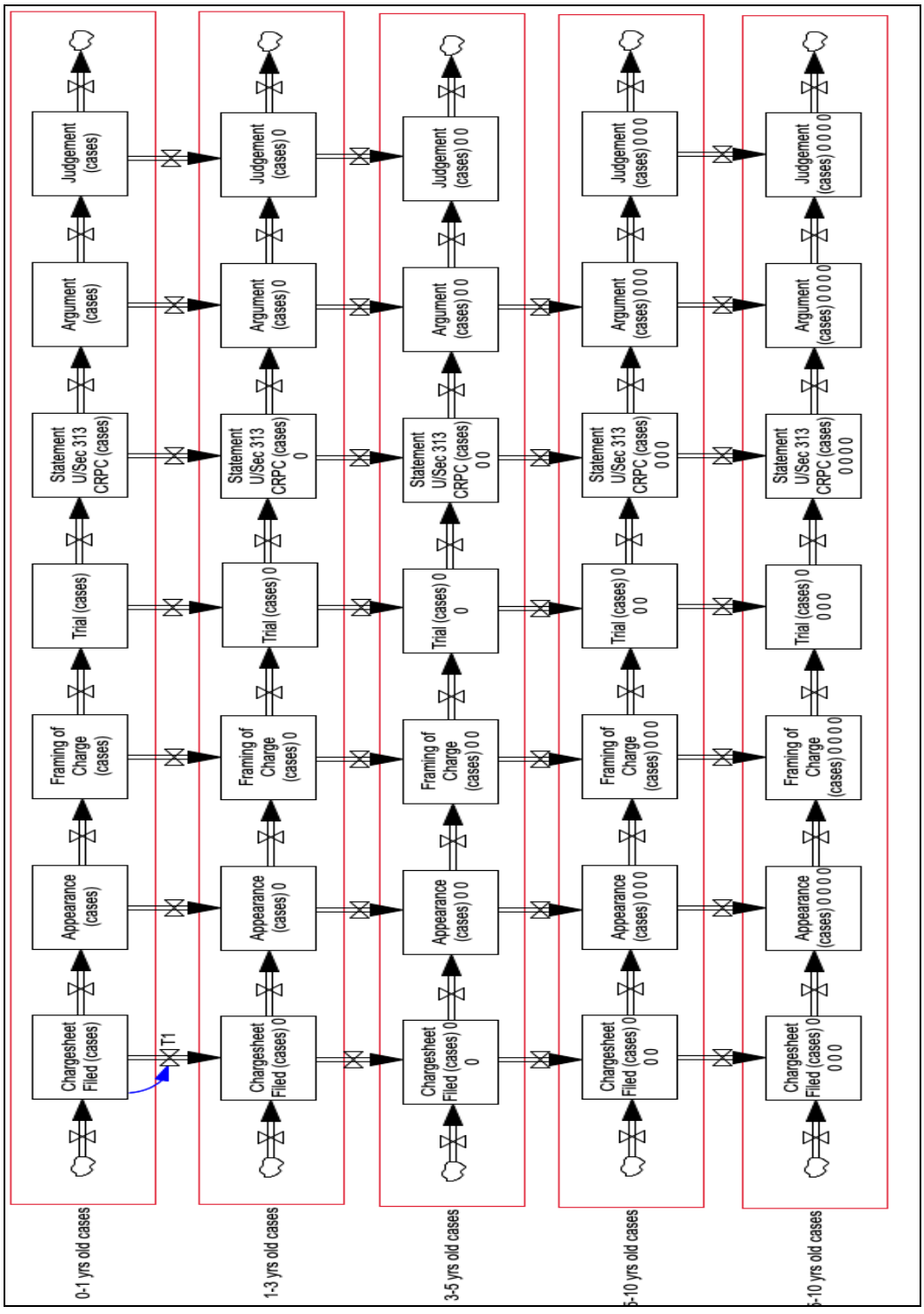

Figure 5.10: Multi-stage model for pending cases across proceeding stage and temporal

5.3 Case Stage-wise Model

To understand the dynamics of the pending cases at each procedural stage, a simplified multi-stage model is taken by aggregating the temporal dimension of the accumulation of cases into the pending cases at a particular stage. Figure 5.11 shows that the case stage-wise stock-flow model has a chain of six stocks representing the cases under each stage of the criminal case procedural cycle discussed earlier. The outflow from each stage depends on the average transit time in that particular stage. The values of average transit time are taken the same as the average days for session courts, mentioned in the “Zero Pendency Court Project" report (DAKSH, 2019b). The report highlights the average days taken by a court to complete different stages in the life cycle of a case if the court has zero pending cases at the start. Since the report does not highlight the value of average days for the appearance stage, we have taken the average transit time as highlighted by one expert. All the transit time values can be seen in Table 5.2. The inflow rate to “case in appearance” is represented by “ArrRt”, and is considered 77 cases per day as the case institutionalisation rate in the Mumbai City Civil Courts as per NJDG. The values for the cases at a particular stage to intialialise the model are considered as per the NJDG website for Mumbai City Civil Sessions case for 2023 and shown in Table 5.3. The Equation for the outflow from Stagei is represented below.

$$ExtRt_i = Cases\ in\ Stage_i / Avg.\ Transit\ time\ in\ Stage_i$$

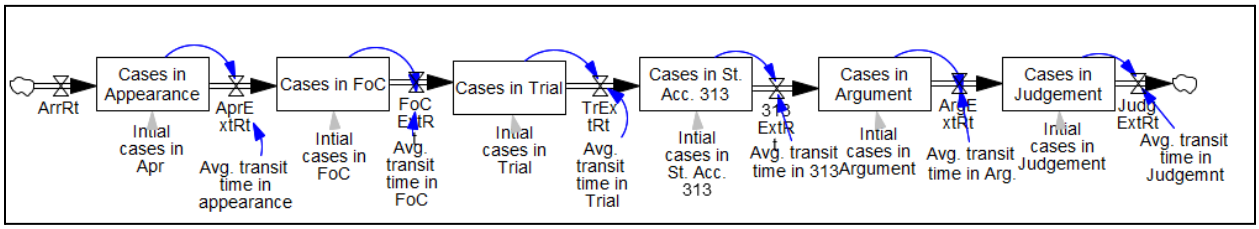

Figure 5.11: Case-stage wise stock-flow model

Variable	Value (Days)
Avg. transit time in Appearance	90
Avg. transit time in Framing of Charges	47
Avg. transit time in Trial	126
Avg. transit time in St. Accuses 313	23

Avg. transit time in Argument	24
Avg. transit time in Judgment	18

Table 5.2 Values of average transit time across the stages of a case proceedings

Initial Cases at	**Value (Cases)**
Appearance	5482
Framing of Charges	6550
Trial	5330
St. Accuses 313	101
Argument	199
Judgment	57

Table 5.3 Model Intialisation values for pending cases across the stages

6. Results and discussions

6.1 Aggregated Models

This section discusses the results from simulating aggregated models M1, M2, and M3 for ten years for all four scenarios, as discussed earlier.

Results from Linear View (M1): The case institutionalisation and disposal rate do not have any feedback relationship with undertrial cases

The results from the simulation are shown in Figure 6.1 for all four scenarios. The results for the business-as-usual scenario indicate that with the present number of judges, the case disposal rate will be lower than the institutionalisation rate, and the number of undertrial cases will continue to rise. The number of undertrial cases grows linearly over time, reaching nearly 1.13 times in 5 years duration. The outflow is directly proportional to the number of judges, so if the judges' strength is not increased to a certain level, which can help in matching the inflow, the undertrial cases will keep on rising, as indicated by Gandhi (2019).

In the scenario when the number of judges is increased to fill the vacancies, we see that the number of undertrial cases begins to decrease since the outflow becomes greater than the inflow. After 5 yrs, the pending cases are 0.76 times the initial value.

For scenario three, the results show that there will be fewer undertrial cases for some time; however, they start bouncing back after some years and will continue to increase owing to the difference in inflow and outflow. After five years, the pending cases are 0.66 times the initial value.

When we combine scenarios two and three, we see that the cases decrease to a minimum level at the end of 10 years. After five years, the pending cases are 0.11 times the initial value.

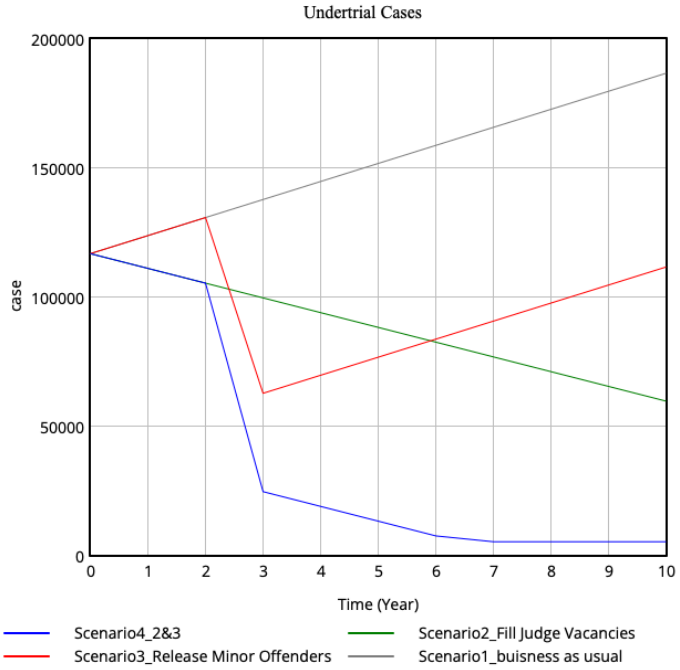

Figure 6.1 Results from the linear aggregated model M1

Results from Feedback View (M2): The case disposal rate is in a feedback relationship with undertrial cases

The results for all the scenarios for this model are shown in Figure 6.2. In the case of the business-as-usual scenario, due to the presence of the reinforcing feedback loop, the undertrial cases increase rapidly since the disposal rate is lower than the institutionalisation rate. From the

behaviour, it can be seen that after 5 years, the pending cases will be 1.65 times higher than the initial value.

In scenario two, the results show that the number of undertrial cases continues to increase, but the increment rate is lower than the scenario one. After 5 years, the number of undertrial cases is 1.16 times the initial value.

In scenario three, the systems will have fewer undertrial cases for some time; however, the undertrial cases will keep rising due to higher inflow than outflow. In this scenario, the rate of increment after the intervention is the same as the scenario one. After 5 years, the pending cases are 0.92 times the initial value.

In scenario four, the results show that undertrial cases continue to decrease. At the end of 5 years, the pending cases are 0.38 times the initial value.

The results for the model indicate that just filling the vacancies of judges will not reduce the pending cases. This intervention must be coupled with other interventions, such as the one-time release of the minor offenders.

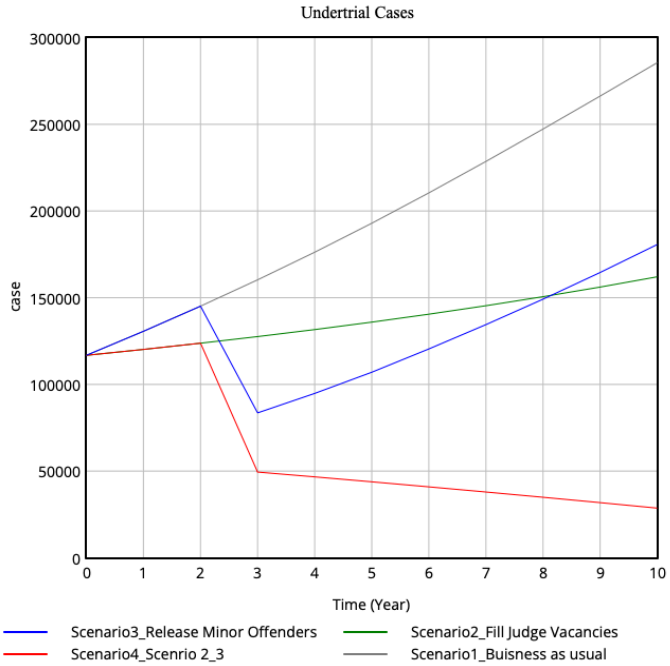

Figure 6.2 Results from the non-linear aggregated model M2

Results from Feedback View (M3): Both the case institutionalization rate and the case disposal rate are in a feedback relationship with undertrial cases

The results for this model are shown in figure 6.3. In a business-as-usual scenario, due to the presence of the two reinforcing feedback loops, the undertrial cases increase rapidly since the disposal rate is lower than the institutionalisation rate. From the behaviour, it can be seen that after 5 years, the undertrial cases are 1.68 times higher than the initial value.

In scenario two, the results show that the undertrial cases keep increasing but the increment rate is less than the business-as-usual scenario. After 5 years, the undertrial cases are 1.2 times the initial value.

In scenario three, the system will have fewer pending cases momentarily; however, the undertrial cases will keep rising due to due to higher inflow than outflow. After 5 years, the pending cases are 0.97 times the initial value.

In scenario four, the results show that undertrial cases decrease for some time; however, they again start increasing. At the end of 5 years, the pending cases are 0.48 times the initial value.

The scenario results suggest that in case of multiple feedback, combining filling the vacancies of judges with the release of minor offenders will also not work in decreasing the pending cases.

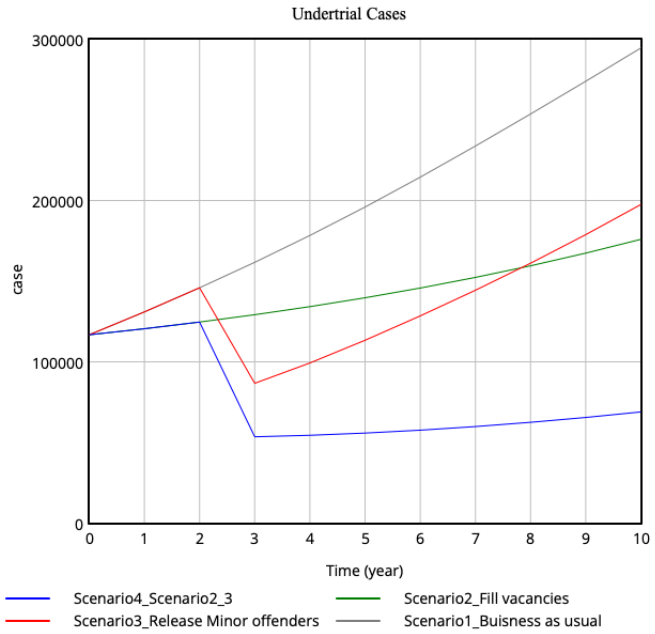

Figure 6.3 Results from the non-linear aggregated model M3

All the results after 5 years for M1, M2 and M3 are consolidated in Table 6.1. It can be seen that for the same scenarios, the dynamics of undertrial cases change depending on the presence of feedback connections. In the following section, we compare the results from each model, M1, M2 and M3, for a particular scenario to understand the difference in dynamic due to the effect of feedback connections.

Scenarios/Models	**No. of undertrial cases after five years (Initial value 116,763)**		
	(M1)	**(M2)**	**(M3)**
1. Business-as-usual	151,679 Cases (x1.3 from initial)	192,929 Cases (x1.65 from initial)	195,952 cases (x1.68 from initial)
2. Fill the vacancies of judges	88,218 Cases (x0.76 from initial)	135,908 Cases (x1.16 from initial)	139,712 Cases (x1.20 from initial)
3. Release minor offenders	76,679 Cases (x0.66 from initial)	107,011 Cases (x0.92 from initial)	113,385 Cases (x0.97 from initial)
4. Combine scenarios 2 and 3	13,218 Cases (x0.11 from initial),	43,817 Cases (x0.38 from initial)	55,837 Cases (x0.48 from initial)

Table 6.1 Simulation results for aggregated model M1, M2, and M3 for all scenarios

Comparison of results for M1, M2, and M3 models for the business-as-usual scenario:

From Figure 6.4, it can be seen that the rate of change of pending cases is much higher in both non-linear models, as compared to the rate of change of pending cases in the linear model. After five years, while the linear model shows an increase in cases by 1.3 times, both feedback view models show the increase in cases to be 1.65 and 1.68 times, respectively. This indicates that if feedback connections are not considered in understanding the dynamics of undertrial cases, then the quantum of the problem will be underestimated. Thus, the proposed solutions will be inefficient.

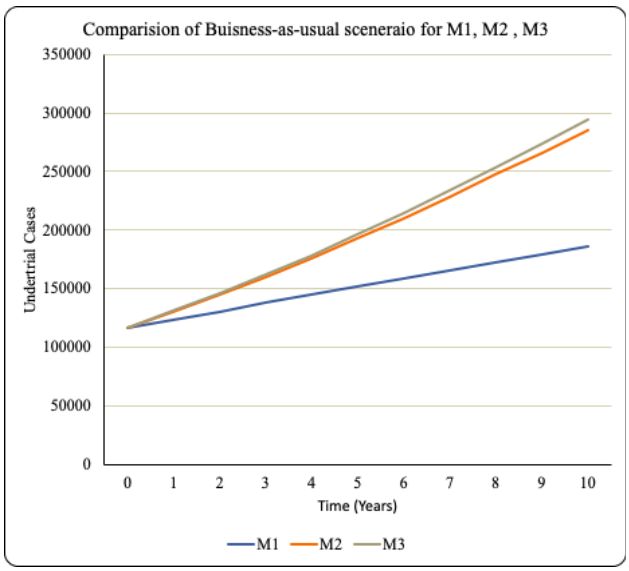

Figure 6.4 Comparison of business-as-usual scenarios for M1, M2, and M3

Comparison of results for M1, M2, and M3 models for filling the judge vacancies scenario:

As shown in figure 6.5, there is a drastic difference in dynamics of pending cases for linear and non-linear models. The linear model shows that pending undertrial cases are reduced by filling the judge vacancies, while the feedback view model shows the opposite results. It indicates that if nonlinearity is not considered while making decisions, the consequences may not be as intended. As a result, the decision to increase the number of judges should consider the feedback link among undertrial cases, the case disposal rate and the case institutionalisation rate.

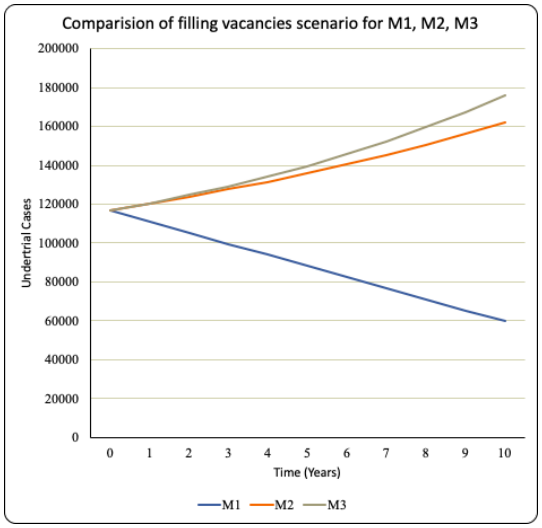

Figure 6.5 Comparison of filling the judge vacancies scenarios for M1, M2, and M3

Comparison of results for M1, M2, and M3 models for releasing the minor offenders scenario:

Figure 6.6 shows that this intervention will not have any long-term effect in reducing the pending cases irrespective of linear or non-linear model. It also indicates that the cases will bounce back at different rates. This rate will be determined by the presence of feedback connections in the model.

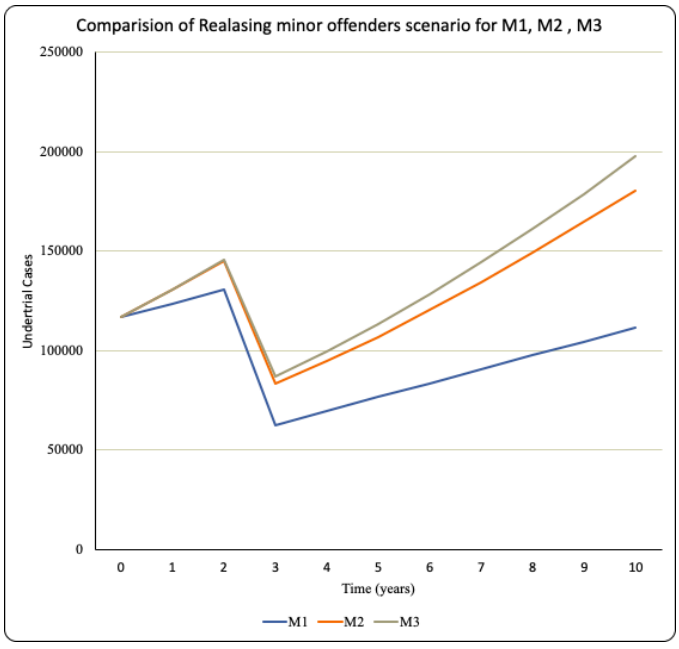

Figure 6.6 Comparison of filling the judge vacancies scenarios for M1, M2, and M3

Comparison of results for M1, M2, and M3 models for releasing the minor offenders and filling the judge vacancies scenario:

Figure 6.7 shows how the dynamics of undertrial cases for all the models are completely different from each other. While M1 and M2 show that combining the filling of the vacancy of judges with releasing the minor offenders will decrease the pending cases, M3 shows that combining these two interventions will not have any long-term effect on reducing the pending cases.

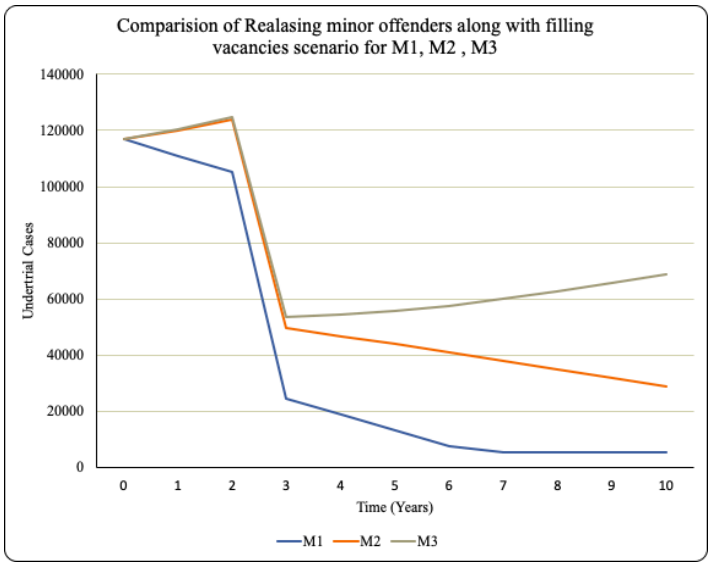

Figure 6.7 Comparing releasing the minor offenders and filling the judge vacancies for M1, M2, and M3

6.2 Case Stage-wise Model

The Case Stage-wise model is simulated to see the dynamics of the pending criminal session cases at Mumbai City Civil Court after 1000 days compared to the initial values, as shown in Figure 6.8. It can be seen that the cases across the stages become constant after some days. The dynamics of cases depend on the initial value of cases in each stage and inflow and outflow rates. It can be seen that where the outflow is higher, the cases decrease; however, it accumulates in the following stages. Table 6.2 shows the percentage change of cases from the initial value, and it can be seen that certain stages act as a bottleneck for the progression of cases, due to which the cases in the stage accumulate and impact the distribution of cases across the stages.

Cases at	T = 0	T = 1000 days	% Change
Appearance	5482	6930	+ 26%
Framing of Charges	6550	3619	- 45%
Trial	5330	9700	+ 82%
St. Accuses 313	101	1770	+1653%
Argument	199	1847	+ 828%
Judgment	57	1385	+ 2330%

Table 6.2 Simulation results for Case stage-wise model

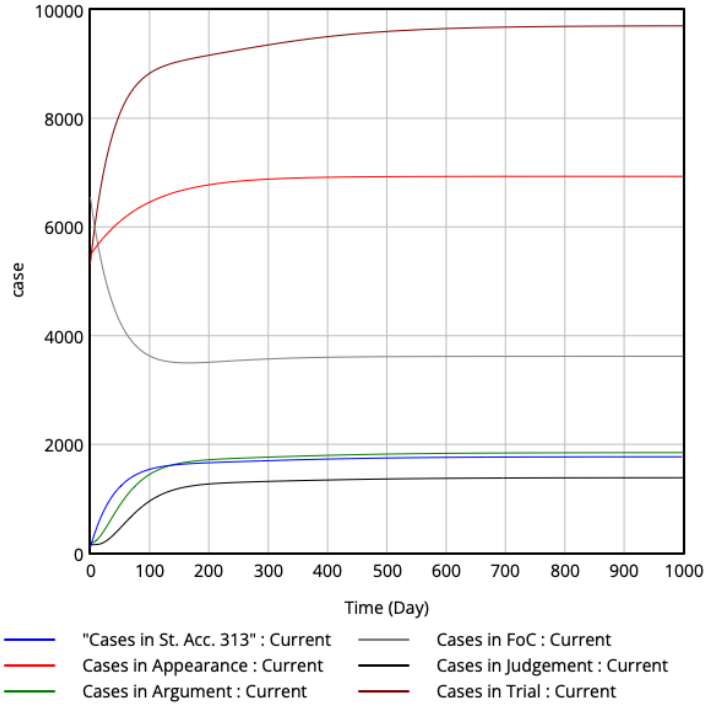

Figure 6.8 Distribution of pending cases across procedural stage

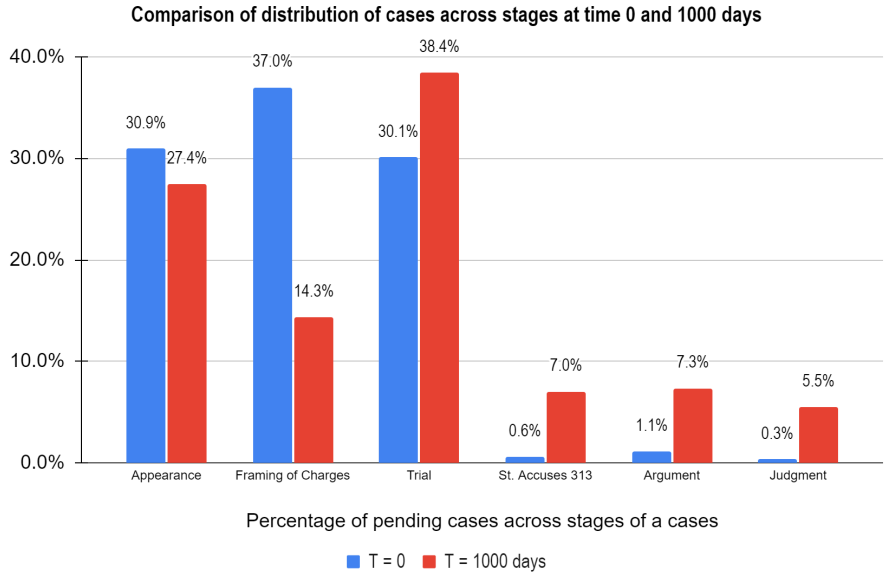

Figure 6.9 Comparison of the distribution of pending cases at time zero and 1000 days

7. Conclusion

Pendency is a complex problem wherein judicial productivity is important in determining the case disposition rate. Results from comparing linear and feedback view aggregated models highlight the importance of the feedback relationships among judicial productivity, institutionalisation rate and pending cases. The results indicate that a solution like increasing the number of judges alone will not significantly reduce pendency due to its non-linear dynamic nature. Further, the results from the disaggregated model indicate that addressing the pendency necessitates identifying the critical procedural stages where the bottleneck exists and then understanding the dynamic complexity at that stage. Overall, we concluded that if feedback induced nonlinearity is not considered while making decisions, the consequences of the proposed interventions will not be as intended.

Apart from this, we also see scope for overall process improvements in the justice system that can bring down pendency. The processes can be improved by deploying a file management system with less human interface, templatising the recording of case proceedings,etc.

8. Way Forward

The project helped us find relevant stakeholders with whom we plan to develop it further. These stakeholders are interested in applying the systems thinking approach to the issue of pendency. Some stakeholders find the systems mapping process helpful and want to use it in classroom teaching.

The model was presented to a few stakeholders at the Bombay High Court. They found the model and the overall system dynamics approach very relevant and are excited to extend this study to examine the pendency issue further in the context of the High Court. We are having a collaborative engagement with them to build the proposed model further by taking into consideration various other dynamics to bring out the intricacies of pendency and associated feedback structures in the systems

Acknowledgement

We would like to express our sincere gratitude and appreciation to the following individuals and organizations who have played a significant role in the completion of this project report.

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